

[54] **COMPOSTING APPARATUS**
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[51] Int. Cl. **B01f 7/04**
[58] Field of Search..... 23/259.1, 259.2, 259.3; 220/41; 241/60, 98; 259/10, 26, 46, 154

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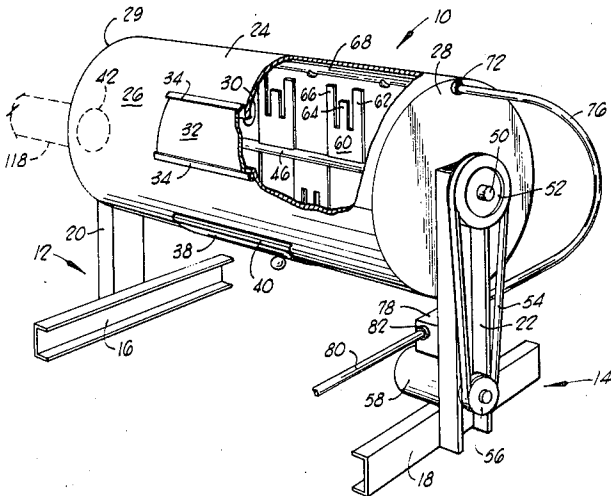
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[57] **ABSTRACT**
An apparatus for controlled compost processing of waste materials to provide rapid and complete reduction to compost material. The apparatus consists of a ground-supported enclosure which includes slidecovered access openings; the enclosure further including a longitudinally arrayed, rotatable agitation assembly and material wetting assembly, each of which is periodically actuatable to provide the requisite mixing and wetting functions. Further, the apparatus is particularly adaptable to novel shredder-grinder apparatus which is attachable through access opening to the composting apparatus, and which serves to receive waste material through a hopper input for introduction to an input cylinder which includes a plurality of axially arrayed, rotationally driven cutting elements operating in coaction with alternating screening discs which provide final forced entry of chopped waste material into the interior of the composting apparatus enclosure.

6 Claims, 7 Drawing Figures



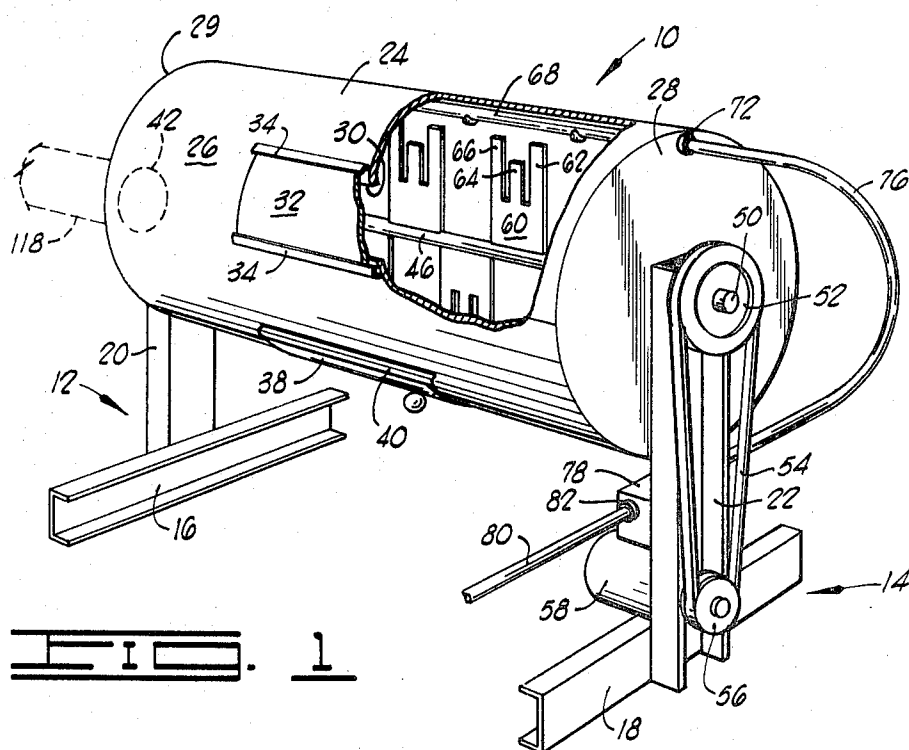


FIG. 1

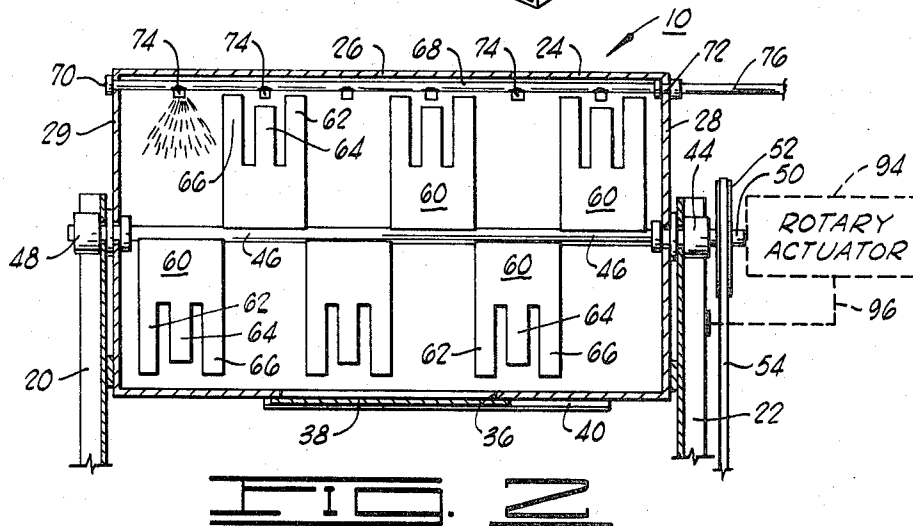


FIG. 2

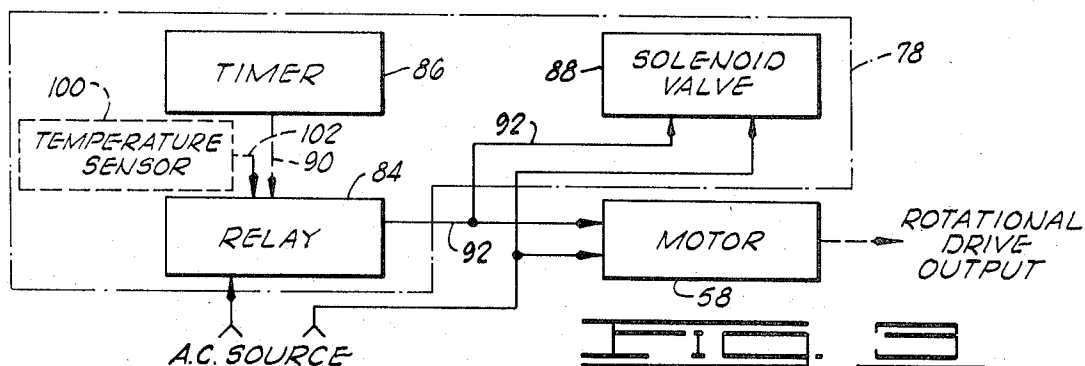


FIG. 3

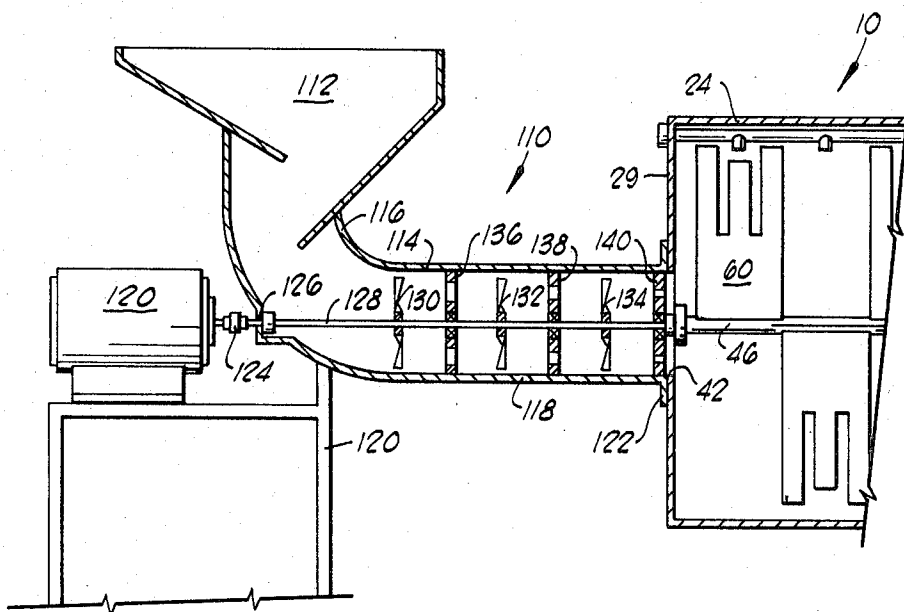


FIG. 4

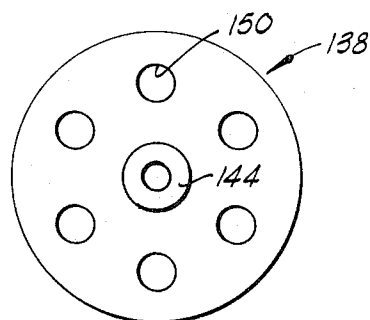
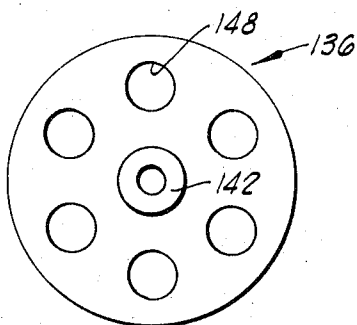


FIG. 5A FIG. 5B

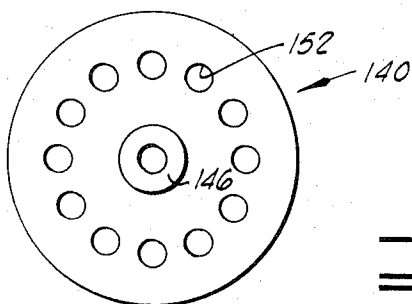


FIG. 5C

COMPOSTING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to composting apparatus and, more particularly, but not by way of limitation, it relates to improvements in waste material grinding and composting apparatus enabling rapid and complete reduction to desirable compost material.

2. Description of the Prior Art

The prior art includes a great many types of composting apparatus as have been functionally and structurally dictated by their particular compost process usages. Thus, there have been many designs formulated for large scale commercial usage in combination with various forms of digester systems, materials screening and metal detection systems, plastic separators, etc., such systems having been variously constructed for utilization of either aerobic or anaerobic waste processing. Much less attention has been given to development of what may be termed small scale composting units or systems, e.g., composting apparatus suitable for utilization about a single family dwelling or other similar usage wherein one man can easily attend to the processing function. Further, the prior art includes little or no teaching of compact composting equipment which embodies specific structural features enabling rapid compost processing as aided by additive bacteria and nutrient materials.

SUMMARY OF THE INVENTION

The present invention contemplates composting apparatus which includes support structure, accessible enclosure structure, and periodically actuatable agitation and wetting assemblies, such periodic actuation being controllable in accordance with pre-settable electrical controlling equipment; further, the invention contemplates a shredder/grinder structure including a waste material input hopper and rotary driven chopping and screening assembly which is coactive for introduction of finely chopped waste material directly into the interior of the composting apparatus enclosure.

Therefore, it is an object of the present invention to provide a composting apparatus which enables rapid and complete composting of waste material.

It is yet another object of the invention to provide composting apparatus which is especially suitable for residential or home usage to provide odor-free compost processing of relatively small batches of waste material.

It is still another object of the present invention to provide a composting apparatus which functions in coaction with a shredder/grinder apparatus of selected capacity and function.

Finally, it is an object of the invention to provide a home composting unit which enables the gardening enthusiast to return a great volume of waste materials to the soil thereby to alleviate waste disposal problems.

Other objects and advantages of the invention will be evident from the following detailed description when read in conjunction with the accompanying drawings which illustrate the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view in partial cutaway of a

composting apparatus constructed in accordance with the present invention;

FIG. 2 is a vertical section of the composting apparatus of FIG. 1;

FIG. 3 is a schematic block diagram of control apparatus utilized in the present invention;

FIG. 4 is a vertical section of a shredder/grinder apparatus constructed in accordance with the present invention; and

FIGS. 5A, 5B and 5C are planned views of screening discs as utilized in the shredder/grinder depicted in FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, a composting apparatus 10 consists of ground support elements 12 and 14 consisting of ground support rods 16 and 18 having respective vertical support rods 20 and 22 affixed thereto as by welding or the like. An enclosure 24 is then affixed by suitable securing to be supported between the upper ends of vertical support rods 20 and 22. The enclosure 24 is shown as being a cylindrical shape having cylindrical side wall 26 and circular end walls 28 and 28; however, the particular volumetric shape may be varied in accordance with the exigencies of usage and requirements of internal functional elements.

The composting enclosure 24 includes a loading aperture 30 which may be secured closed by means of a sliding cover plate 32 supported between slide guides 34 as secured in suitable manner to the outer surface of side wall 26. In like manner, an unloading aperture 36 (see FIG. 2), formed in a lower extremity of composting enclosure 24, is closed by means of a sliding cover plate 38 movable between parallel slide guides 40. Yet another access aperture 42 is shown in dash-lines as provided near the circular edge of end wall 29 to provide for entry of shredded or ground material, as will be further described below.

Vertical support 22 is securely affixed to end wall 28 of enclosure 24 by such as a bearing block 44. Bearing block 44 may be secured as by welding through end wall 28 and vertical support rod 22 to provide journal support for a rotatable agitation shaft 46. Similarly, the opposite end of shaft 46 is journaled through a bearing block 48 as secured through each of enclosure end wall 29 and vertical support shaft 20. An outer end 50 of shaft 46 has secured thereto a drive pulley 52 of selected radius, and pulley 52 is driven by means of a drive linkage 54 in engagement with a drive pulley 56 which receives rotational output from a suitable electric motor 58 (see FIG. 1 as secured along the lower portion of vertical support rod 22. The motor 58 securing seat would preferably be made adjustable in order to allow drive belt, or in other cases drive chain or the like, adjustability.

The agitation shaft 46 is constructed to include a plurality of agitation plates 60 as shown secured in alternating planar relationship to the shaft 46 and extending across the axial length of composting enclosure 24. The agitation plates 60 may be constructed of suitably formed metal plates welded to shaft 46 and each including such as extension tines 62, 64 and 66 at their outer extremity. The plates 60 with tines 62-66 embody a design which is particularly suitable for home composting usage in processing of leaves, grass cuttings, light waste, etc., however, it should be under-

stood that the particular shape is susceptible of variation and particularly with respect to processing of specialized forms of waste. The agitation plates 60 are designed to be of a length such that the body of revolution outlined during the rotation of shaft 46 allows a slight clearance relative to the inner side of enclosure side wall 26, thereby to allow for placement of a wetting pipe 68. The wetting pipe 68 is suitably secured across the uppermost portion of composting enclosure 24 between a stopper fixture 70 through side wall 29 and a feed-through fixture 72 secured through side wall 28. The wetting pipe 68 then includes a plurality of spray nozzles 74 periodically disposed across the interior of composting enclosure 24, and water is supplied via liquid-tight affixture of feedthrough fixture 72 to a hose or tubing 76 leading downward to a control box 78 which is suitably secured at an accessible location. External water supply may be supplied by permanent installation, but it is contemplated that water be introduced through a garden hose 80 and garden hose connector 82 affixed to control box 78.

Referring now to FIG. 3, the control box 78 is indicated by dash-line and includes a relay 84, a timer 86 and a solenoid valve 88 as energized by a suitable a-c source made available thereto. The timer 86, e.g. a commercially available type of timed periodic actuator, provides actuation via line 90 to close the control relay 84 such that closure of the a-c power circuit is available via line 92 to energize each of the solenoid valve 78 and the drive motor 58. Thus, timer 86 may be set for such as a three minute activation each 12 or so hours so that sufficient periodic agitation and wetting is carried out. That is, solenoid valve 88 is actuated to allow spraying of mist from spray nozzles 74 for the pre-set activation duration, and motor 58 is energized to provide rotation of shaft 46 and plates 60 to repeatedly turn and fluff the waste material within composting enclosure 24.

FIG. 2 also shows an alternative form of rotary actuator 94 which may be such as an electric motor and reduction gear box supported by attachment of a suitable support 96 to vertical rod 22, and connected for direct drive of shaft 46 and agitating plates 60. Still further, rotary actuation of shaft 46 may be carried out manually by means of a suitable crank means as it is only necessary to turn and agitate the waste material for a short period of time each day of processing. It is also contemplated to include a manual switch within the circuitry of FIG. 3, so that motor 58 and solenoid valve 88 can be energized at will as required during such as loading of waste material, flushing of the internal space, etc. Most commercially available timers employed as timer 86 include manual actuation means operating in override of the timed actuation output.

In operation, selected waste materials such as raked leaves, grass clippings, pine needles, small twigs and grove rakings, and the like, may be inserted through loading aperture 30 with addition at that time of desired bacteria and/or enzyme additives to serve as digestion activators. The cover slide plate 32 may then be closed and timer 86 of control box 78 set to provide for periodic activation to supply misted water spray via spray nozzle 74 during agitation via shaft 46 and paddles 60. The vertical supports 12 and 14 may be of proper height and spacing to allow packing of a yard cart or wheelbarrow directly under the apertures 30 and 36, thus to aid in loading and unloading of enclosure 24.

Still another alternative may be employed in the form of a temperature sensor 100 (FIG. 3) providing actuation of relay 84 via linkage 102 upon sensing of less than a pre-determined temperature near the lower extremities of composting enclosure 24. Temperature sensing may be carried out by conventional structure such as thermocouple affixture or the like. Thus, after each agitation, as the composting activation begins and digestion proceeds the temperature rises and then falls as the digestion process subsides. As the internal waste mass cools, temperature sensor 100 may be set to activate relay 84 to re-wet and reagitate the mass thereby to initiate a new cycle of digestion with its characteristic heating and then cooling to normal or ambient temperature. Compost testing of selected leaf matter has indicated increase in temperatures upwards of 140°F.

FIG. 4 illustrates a composting unit 10 in conjunction with a shredder/grinder unit 110 which is readily connectable via aperture 42 (FIG. 1) in coactive association therewith. The shredder 110 consists of a suitable hopper configuration 112 in connection with a shredder conduit 114 formed from suitably selected steel material to include an elbow portion 116 and a cylindrical portion 118 through which the shredder processing is carried out. A support structure 120 provides support for both the shredder conduit 114 and an electrical drive motor 120 of selected horse power rating, speed, etc. A flange 112 is provided on the end of shredder cylinder portion 118 in order to provide a bolting surface for secure affixture to end wall 29 when shredder unit 110 is in proper alignment with aperture 42.

The motor 120 is connected via a coupling 124 and journal entry 126 through the elbow portion 116 of shredder conduit 114, to impart rotational motion to a drive shaft 128 which has affixed thereto a series of chopper-impeller blades 130, 132 and 134. The chopper-impeller blades may each be of similar formation to include a plurality of radially extending chopper blades each turned at a pitch to impart impeller action of the chopped waste material inward toward aperture 42. A series of screening discs 136, 138 and 140 are disposed inwardly adjacent each of the respective chopper-impeller blades 130, 132 and 134. The screening discs are as shown in FIGS. 5A, 5B and 5C with each having a respective central bearing block 142, 144 and 146 for supporting the drive shaft 128 therethrough. It may be noted, too, that screening holes 148, 150 and 152 of each of screening discs 136, 138 and 140 are reduced in size in accordance with their increased proximity to entry aperture 42 of composting enclosure 24. Thus, and by way of example, the most external screening disc 136 may have such as 1 inch holes 148 disposed in concentric array, while the next more proximate screening discs 138 has $\frac{3}{4}$ inch holes 150 and the nearest screening disc 140 has $\frac{1}{2}$ inch holes 152. The size and number of holes as well as their particular array about the screening discs are a matter of choice depending upon the material being processed or shredded for composting. It may also be desirable to optimally shape the external faces of each of the screening discs 136-140 to provide for the least coagulating flow of shredded materials therethrough. Commercial construction would also probably dictate the inclusion of access panels in shredder conduit 114 for purposes of cleaning and flushing.

The shredder unit 110 when used in combination with the composting unit 10 provides a complete and efficient waste processing system which can be used around homes or other smaller installations having lesser waste requirements. Pre-shredding of the input waste material has several favorable effects on the composting process. It causes the surface area of material on which micro-organisms can multiply to be greatly increased; the texture of the mass is improved because the shredded materials have less tendency to mat or pack down; moisture control capability is improved; and, the agitation of the composting waste material is made much easier.

The present invention can be used to accomplish quick, odorless composting and can even be operated in an enclosed space such as a garage without causing unpleasant odors or deleterious effects. This odor-free attribute is accomplished due to the fact that during the repetitive composting process, the heat generation periods cook out the odors normally associated with manure, garbage and other wastes, and the micro-organisms use the carbon available for conversion to carbon dioxide. The conversion process reduces the bulk mass thereby to cause enrichment of the material.

The foregoing discloses novel apparatus for enabling fast and efficient composting of smaller bulk amounts of waste material. The apparatus is suitable for use with any of the various and diverse types of waste, e.g., any of the nitrogen rich, carbohydrate rich or cellulose rich waste materials, and it is probable that the gardening enthusiast will contribute waste proportions in accordance with his particular soil enrichment requirements. Use of the shredder-composting apparatus combination, especially as employed to greatest efficient with bacterial and bacteria-nutrient additives, enables production of high quality compost material in as little as three days, which process can be repeated indefinitely to provide more than an adequate quantity of soil enrichment material for the average home owner or groundskeeper.

Changes may be made in the combination and arrangement of elements as heretofore set forth in the specification and shown in the drawings; it being understood that changes may be made in the embodiments disclosed without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. Composting apparatus comprising:

enclosure means of generally elongated shape and including side walls and end walls defining a generally cylindrical internal space, said enclosure means having at least one closeable access aperture;

agitation means consisting of a shaft and a plurality

of plates secured to extend perpendicularly from said shaft, said shaft being journally supported by said enclosure means end walls axially through said cylindrical internal space;

wetting means including a water delivery pipe having a plurality of spray nozzles attached in communication therewith, said pipe being secured across the upper extremity of said cylindrical internal space;

a water supply connected to said wetting means; rotary drive means connected to said agitation means shaft;

an a-c source;

a solenoid valve connected in said water supply to control flow therefrom;

electrical relay means connected to said a-c source and being energizable to provide output electrical energization to said solenoid valve means and said rotary drive means; and

temperature sensor means in communication with said enclosure means internal space and energizable upon sensing of less than a pre-determined temperature to cause energization of said electrical relay means.

2. Composting apparatus as set forth in claim 1 which is further characterized to include:

ground support means consisting of frame support members secured to each end wall of said enclosure means.

3. Composting apparatus as set forth in claim 1 which is further characterized in that:

said enclosure means side walls include a first loading access aperture coverable by a sliding plate closure disposed at an upper surface of said enclosure means side walls, and an unloading access aperture covered by a sliding plate closure disposed at a bottom location of said enclosure means side walls.

4. Composting apparatus as set forth in claim 1 wherein each of said plurality of agitation means plates comprises:

a planar plate having one end formed linearly for affixture to said shaft and having the other end formed as a fork-like structure having a plurality of tines.

5. Composting apparatus as set forth in claim 4 which is further characterized in that:

each successive one of said plates as secured along said shaft is secured on the opposite side from the preceding plate across the length of said shaft within the cylindrical internal space.

6. Composting apparatus as set forth in claim 1 wherein said rotary drive means is an electric motor mechanically linked to provide rotational drive output to said shaft.

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